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THE DEVELOPMENT OF DECENTRALIZED SYSTEMS OF BUILDING MATERIALS PRODUCTION IN AFRICAN COUNTRIES

SUMMARY

on the development of decentralized systems of building materials production in African countries

The objective of the study "The Development of Decentralized Systems of Building Materials Production" is to highlight some aspects of building materials industry in order to assist the governments of African countries in planning and implementation of building materials development programmes.

The products of building materials industry cover a wide range and find a variety of uses in new building and engineering constructions as well as in the maintenance and renewal of existing constructions, so the goal in the creation of a viable local building materials industry derives from the awareness to achieve an increasing measure of self-reliance in all facets of national economic-life through the optimum utilization of the existing local resources.

A brief overview on conceptual framework and importance of the building materials industry to national socio-economic development is given in the Chapter I of the study.

Chapter II is dealing mainly with the needs for Decentralized systems of building materials production in the light of needs for local production as well as stimulus for diversification in range of available building materials. The term "Decentralization" used in this study has a limited meaning and refers to the process of establishing plants of varying sizes and employing of mix of large-scale, medium-scale and small-scale technologies based on the raw materials available in different locations within the African countries.

The study underlines, that properly planned Decentralized systems of building materials production could make an important contribution towards improving the supply situation of some essential building materials, particularly towards the low cost construction. In connection with it an attention should be given to the development of an informal sector of the building materials industry. In many African countries, most of dwellings for urban and rural population are constructed using such building materials as sun-dried mud blocks, cement blocks, wooden doors and windows as well as clay tiles for roofing. For a majority of these materials, the production is usually organized in small-scale plants which can be termed "informal sector of the building materials industry" when related to conventional systems of production.

Small-scale building materials production in the context of the informal sector of building economy is an activity which has been established on an extensive scale in most African countries.

This sector can operate with little or no dependence on support from national governments. Even though the sector could probably maintain its current role without any external support, it seems reasonable to suppose that constraints which limit the maximization of development contributions from the sector could be reduced by providing some forms of assistance.

PREFACE

The building materials industry in several African countries has failed to meet the requirements of the construction industry for building materials in the desired quantities and at affordable prices. The result has been a slowing down of the pace of implementation of projects and the augmentation of construction costs. African governments are conscious of the need to achieve an increasing measure of self-sufficiency in the supply of building materials and have accordingly included the building materials industry among the core industries for the Industrial Development Decade for Africa programme.

The basic problem of the building materials industry stems primarily from the failure of the few large-scale plants, set up in centralized locations to produce a limited range of materials, to achieve the expected output levels. The need to review past strategies and adopt new approaches to the development of building materials production became apparent.

This document has been prepared by the Economic Commission for Africa to assist African Governments in the planning and implementation of building materials development programmes based on the concept of decentralization and diversification of production.

The document consists of an introduction and six chapters. The introduction discusses the development of the building materials industry and the concept of decentralization. Chapter I gives a brief overview of the industry covering the conceptual framework of the industry, its importance to national socio-economic development, its linkages with other industries and sectors, and the prospects for its development in African countries. In Chapter II the need for decentralized systems of building materials production is analysed. Chapter III deals with the problems associated with decentralized systems of materials production and how they could be overcome. Chapter IV is devoted to a discussion of the various elements concerning the planning of decentralized production systems, including basic data for planning production systems, the choice of materials to be produced, the choice of production technology, the assessment of infrastructural facilities, manpower needs, the preparation of the building materials development plan and the machinery for the coordinated planning and development of the industry. The implementation of programmes and projects for the establishment of building materials production units is the subject of discussion in Chapter V. Chapter VI gives a summary of some of the main policy measures that should be considered for implementation by African governments with regard to the planned and coordinated development of the building materials industry.

This informal sector of production, as with several other informal-sectors economic activities, has emerged partly as a continuation of age-long traditional activities but also as a modern system of production to provide such elements as sun-dried mud blocks, cement blocks, stone blocks, wooden doors and windows which the conventional systems of production have not been capable of providing to the satisfaction of the entire construction market.

Since the sector has a potential for generating skills and high levels of employment as well as ability to stimulate growth of production in other sectors, governments could consider their support for the informal sector as a significant strategy in the context of an overall economic development plan.

Because of implementation of Decentralized systems involves a number of related problems the study considers the factors as absence of basic infrastructure and complementary industries, which could act as severe hindrances to the implementation of the decentralized production systems as well as the problems relating to availability of suitable technologies and energy (Chapter III).

As is pointed in the Chapter IV of the study, to implement the Decentralized systems of building materials production it should be properly planned, so to the purpose, basic data for planning should be available and investigated. On the issue, priority should be given to studying natural resources, production and consumption of building materials and its perspectives. It is necessary to select the building materials for local production and to make a choice of production technology as well as to assess infrastructural facilities and manpower needs.

Because of a decentralized system of building materials production is a part of state building materials industry, it should be include in the building materials development plan, implementation of which is under control and coordination of the state machinery.

Practical recommendations on implementation of programmes and projects for the establishment of building materials production units are given in the Chapter V and VI of the study.

They are covering the following elements:

- Basic requirements
- Institutional support
- Small-scale industries development organizations
- Incentives for building materials production
- Financing of building materials projects
- Mobilization of funds from local sources
- Research and development activities
- Information, training and extension services
- Local fabrication of machines, equipment and tools
- General policy measures

INTRODUCTION

The development of the building materials industry and the concept of decentralization of production

1. The development of a local building materials 1/ industry has assumed increasing importance in all African countries because of a growing concern among Governments of severe constraints to the implementation of construction programmes arising, among other factors, from the periodic and sometimes chronic shortages of essential building materials which have also become very expensive with time. Hitherto there has been heavy dependence on imported items of building materials, however dwindling foreign exchange reserves and competing demands by other sectors of the national economy for these limited resources, have made it increasingly difficult for Governments to maintain imports of building materials at levels commensurate with the requirements of the construction sector.

2. The interest in the creation of a viable local building materials industry also derives from the awareness to achieve an increasing measure of self-reliance in all facets of national economic life through the optimum utilization of resources available locally. In the context of the building materials industry this means the exploitation of potentially - useable raw material deposits of various sizes that are found in different locations across the national geographical space to produce building materials required by both the formal and informal construction sector.

3. In their programmes to develop the local building materials industry several African countries initially adopted a strategy which favoured the installation of large-scale, capital-intensive plants sited in a few locations and producing a limited range of materials which met the specifications of building codes and regulations based essentially on foreign design concepts and building technology. The failure of such plants to make an appreciable impact on the supply of building materials and its causes are well known - wrong choice of technology, lack of qualified technical, supervisory and managerial personnel, maintenance and repair problems caused sometimes by lack of foreign exchange to import needed spare parts, low utilization of installed plant capacities, distribution problems arising from long-distance haulage over poorly developed transport networks, etc.

4. In the light of the problems that have been experienced with regard to efforts aimed at increasing the production locally of essential building materials it becomes necessary to review past strategies and formulate new approaches for adoption.

Decentralization of building materials production

5. The term decentralization used in this document has a limited meaning and refers to the process of establishing plants of varying sizes and employing a mix of large-scale, medium-scale and small-scale technologies based on the raw materials available in different locations within the country with the following objectives in view:

(a) contributing generally to improving the supply of building materials to the construction market at different demand points and minimizing the rate of price escalations;

1/ In the context of this discussion the term "local building materials' refers to all materials produced locally from essentially locally available resources, although there may be some imported inputs.

(b) diversifying the range of materials available for construction through rational exploitation of all potentially useable raw material deposits;

(c) making use of raw material deposits of different sizes to meet the demands of different market sizes and climatic conditions;

(d) reducing the problems associated with long-distance transportation of a limited range of building materials produced in a few centralized locations.

6. Another aspect of decentralization that has relevance to this discussion concerns the splitting of the production process among different locations. For example, in the production of portland cement, it might be found, economically, advantageous under certain conditions to set up a clinker plant at one location and then grinding centres at other locations where the clinker will be interfuse with gypsum and other additional elements to produce cement.

7. Decentralization of the system of building materials production as explained above entails some implications with regard to programme planning and implementation, if successful results are to be achieved. These include the following:

(a) Provision of basic infrastructure and services - roads, water supply, electricity (energy), etc. to facilitate establishment of production units;

(b) Knowledge of the raw material situation and production possibilities in different regions and districts within the country;

(c) Availability of a bank of technologies to support different scales of production in various localities;

(d) Existence of research and development infrastructure to assist in the development and adaptation of production technologies to suit local conditions and to assist in the transfer of such technologies to prospective entrepreneurs and other users;

(e) Development of indigenous capacities for the design and fabrication of machines, equipment and spare parts to meet the requirements of production units;

(f) Existence of technical, financial and promotional organizations to assist investors in the public and private sectors, and in the large, medium and small scale sectors;

(g) Development of a cadre of technical, supervisory and managerial personnel, including entrepreneurs, to ensure the successful establishment and operation of materials production units;

(h) Creation of suitable institutional mechanisms to provide the framework for co-ordination of efforts of all concerned organizations and undertake preparation of plans and programmes and monitor their implementation.

8. It is clear from the foregoing that the successful promotion of a decentralized approach in the production of building materials requires a deliberate planning and promotional effort by governments to create those conditions that would favour the

establishment of production units not only in urban settlements, but also in small town and rural locations where market and other locational considerations would normally rule out such investments.

CHAPTER I

THE BUILDING MATERIALS INDUSTRY - A BRIEF OVERVIEW

Conceptual framework of the building materials industry

9. The building materials industry, whose output - building materials and components - constitute an indispensable input for the implementation of construction projects, is difficult to define precisely, and no generally accepted definition exists. The difficulty in formulating a precise definition for the industry stems mainly from three factors: the existence of an overlap between the building materials industry and other industries, particularly the construction industry; difficulties relating to the classification of plants producing materials such as iron and steel, plastics, ceramics, wood and wood-based products, which are used in industries other than construction, and; problems associated with the recognition of the production of some materials as a manufacturing activity.

10. The products of the building materials industry cover a wide range, and find a variety of uses in new building and civil engineering constructions, as well as in the maintenance and renewal of existing constructions. They include cement and cement-based products, iron and steel products, other metal products, wood and wood-based products, bricks and other burnt clay products, glass, paints, sanitary ware and roofing materials. At the other end of the spectrum of materials are fittings, such as hinges, padlocks, nails, screws and bolts. It is important to give proper recognition to the full range of materials required by the construction industry and plan for them accordingly since critical shortages of even low value materials like hinges and nails can lead to considerable delays in the completion of certain construction projects.

11. The building materials industry is characterized by flexibility in choice of production technology for a number of materials. The industry therefore comprises both highly capital intensive plants and low capital, labour-intensive plants. Possibilities exist in between these two extremes for technologies with varying capital-labour ratios. Large scale plants exist together with small-scale artisanal plants, each category producing materials to satisfy the requirements of specific user groups. Thus, high technology, large scale plants producing high quality bricks are found alongside artisanal plants producing bricks of a much lower quality. Plants for materials like glass, iron and steel, and cement however, tend to use high technology with high output levels.

12. The main participants or actors involved in the building materials industry are the manufacturers, both in the formal and informal sectors, the distributors/retailers, and the consumers, both private and public. The activities of informal sector manufacturers are usually not sufficiently reflected in statistics on the output of the building materials industry probably because they are not officially registered, and thus not recognized as manufacturers. In some countries however, the informal sector produces significant quantities of materials like burnt bricks, lime and concrete blocks.

13. Even though their functions may only be partly concerned with the building materials industry, bodies such as financial institutions, building research and standards organizations, and industrial promotion organizations constitute important links in the process of achieving the output of the industry. Their roles and

contributions should therefore be reflected in discussions and programmes aimed at resolving the inherent problems of the building materials industry.

Importance of the building materials industry to national socio-economic development

14. The importance of the building materials industry to the national economy can be assessed primarily by its contribution to construction output. Building materials and components account for about 60 per cent of the total value of construction output, the remainder being accounted for by labour, plant, equipment and overhead. The construction industry itself contributes about 40 to 50 per cent of capital formation and 4 to 11 per cent of gross domestic product in African countries.

15. Over 3 billion dollars are spent annually by African Governments to import building materials and components from overseas markets. This is about half the amount spent on food imports annually. It goes without saying that concerted local production geared towards import substitution would greatly help to release some foreign exchange which would otherwise have been committed to building materials imports, for meeting other national import needs.

16. Inadequate supply of essential building materials does not only result in a long list of uncompleted projects which lock up much-needed capital; it also leads to cost escalation in construction which is detrimental to the quest for economic use of scarce financial resources. The availability of abundant supplies of building materials at affordable prices is a prerequisite for the successful implementation of housing programmes geared to the satisfaction of one of the basic needs of the population, namely, shelter.

17. Apart from its significant contribution to the creation of social overhead capital - buildings, civil engineering works, etc. - required for production activities in other economic sectors, the building materials industry also contributes to employment generation and income redistribution. Statistics on its contribution to employment creation are however lacking since the industry is very often treated under the construction industry in national accounting.

18. Building materials production at all levels, promotes the development of skilled manpower which is not only an asset for the further development of the industry itself, but could easily be employed in other sectors of the economy.

Relationship to construction industry and other inter-sectoral linkages

19. The construction industry is the primary consumer of the output of the building materials industry; the linkage between the two is so strong that it is impossible to consider one without giving attention to its impact on the other. Thus, any upward or downward movement in the volume of construction activity exacts a proportionate effect on the building materials industry. Unstable construction demand schedules therefore, pose a serious constraint to the orderly and planned development of the building materials industry. In a similar way shortages of building materials and components adversely affect the pace of construction projects, causing delays which eventually lead to high construction costs. An important deduction from this analysis is that building materials should be produced to meet anticipated construction demand, and that in planning construction programmes adequate attention should be given to the ability of the building materials industry to supply the required inputs.

20. Through its contribution to construction output, for example, irrigation schemes, dams, roads, buildings, etc., the building materials industry reveals its relationship with other sectors like agriculture, energy, transportation and manufacturing. This relationship with other sectors like agriculture, energy, transportation and manufacturing. This relationship extends to virtually every sector of national economic activity. Building materials production units generate backward linkages through the consumption of inputs from other sectors, as for example, in the manufacture of plant, equipment, tools and spare parts. One has to admit that in the majority of African countries this kind of manufacturing activity has not developed to an appreciable degree. This factor seriously hampers the development of local technological capabilities and the maintenance of imported technologies in a situation of foreign exchange shortage for the importation of spare parts.

Present situation and prospects for development

21. The building materials industry is important to national socio-economic development, particularly through its contribution to the creation of social overhead capital. The industry is however plagued with several problems. In many African countries there is shortage of much-needed building materials and what is available is expensive. This situation has been caused mainly by the lack of foreign exchange for importation of building materials, and by the poor performance of production plants that have been set up.

22. The building materials industry in several African countries is generally characterized by: a low growth rate; lack of decentralization and diversification of production; use of inappropriate production technology; low utilization of installed plant capacities; low level of technical and managerial skills; inadequate standardization and quality control; inadequate research, technology and information infrastructure; and inadequate policy, planning and promotional support.

23. The planned development of the industry in order to enhance its capability to meet national requirements of building materials and components at reasonable prices and in the required quantities has not received high priority in many national development plans. There is still need for the generation of workable policies geared towards the coordination of the development of the building materials industry with the anticipated demand for construction.

24. Available information shows that African countries have great potential in terms of raw material availability, to increase local production of various building materials like cement, lime and lime-pozzolana, burnt clay products, wood and wood based products, sanitary ware, etc., This would not only increase the supply of building materials, but also help to reduce the dependence on foreign sources of supply. Even though the raw materials and other factor inputs are not evenly distributed among the different countries in the region, possibilities do exist, within the framework of the principle of collective self-reliance, for groups of countries to undertake joint actions for the production and distribution of specific building materials.

25. The modality for increasing the supply of building materials could be viewed in the light of three component parts each of which should be accorded priority attention.

(a) Achievement of better utilization of already installed production capacities based on an in-depth evaluation of the problems of the plants and

implementation of the necessary remedial measures;

(b) Planning and establishment of new plants based on an assessment of future building materials needs and an evaluation of local raw materials that could be most advantageously used in the light of the availability of other factor inputs;

(c) Development of "new" building materials based on available raw material resources and successful Research and Development work carried out within the countries, other African countries or elsewhere. The use of agricultural and industrial waste materials as well as other potential resources hitherto neglected should be encouraged.

26. In order to fully realize the potential offered by available resources for increasing the supply of building materials through local production efforts, some basic conditions need to be fulfilled. They include the following:

(a) Renewed political commitment - this should lead to the formulation, by governments, of clearly-defined policies and long-term programmes for the building materials industry, coupled with adequate financial allocation to ensure achievement of targets of planned programmes;

(b) Development of effective research and information infrastructure - to provide suitable technologies, assist in standardization and quality control, formulation of locally-relevant building codes and regulations and propagation of information to various user-groups;

(c) Emphasis on manpower development and training - to provide managerial and technical skills to cope with the requirements of technologies adopted,

(d) Development of tools and spare parts industry - to fabricate simple tools and machines for the building materials industry and also spare parts for the repair of building materials plant and equipment.

CHAPTER II

THE NEED FOR DECENTRALIZED SYSTEMS OF BUILDING MATERIALS PRODUCTION

The need for local production of building materials

27. The necessity to emphasize the local production of building materials in African countries stems primarily from the origin and nature of supply of the bulk of materials used especially in the modern construction sector. The procurement of materials from overseas sources, stimulated during the colonial era and reinforced by acquired official and public prejudices, foreign educational curricula and design concepts, has contributed to the poor state of the building materials supply situation in many countries in recent times. Dwindling foreign exchange reserves have necessitated the reduction, sometimes drastic, in the financial allocations for the import of finished materials and components, as well as raw materials and spare parts for plants set up as import substitution industries. The resulting shortages, chronic in some countries, and the consequent high cost constitute a serious constraint to the smooth implementation of both public and private construction programmes.

28. Arguments could be made in favour of continued importation of some building materials in countries where foreign exchange constraints do not exist, on the grounds that locally produced equivalents would be more expensive. This might be sustainable only in the short-term. Imported inflation resulting from high production, energy and transportation costs in the countries of origin could eventually lead to uncontrollable price escalations. The current situation in a number of countries has been caused precisely by this phenomenon.

29. The justification for the local production of building materials should therefore be viewed in the context of national economic and social considerations. The urge to achieve a measure of self-sufficiency in the supply of building materials based on maximum utilization of locally available resources, the creation of employment opportunities, the conservation of foreign exchange to be used for other pressing national needs and the enhancement of the development of the local industrial sector, are all important factors that need to be kept in view.

30. It would become necessary sometimes to set up plants for which a portion of the raw material inputs would have to be imported. In such cases, the need for maximising the use of scarce resources should underlie considerations of technology choice at the planning stage. Technologies which entail the use of less of the scarce capital- and foreign exchange resources would be preferable.

31. The continued importation of certain items of building material may be necessary mainly because their production locally may not be feasible. In such cases, investigations could be made to explore the possibility of introducing substitute materials produced locally as a long-term objective.

32. In summary, the guiding principle with regard to decisions on the production of building materials should always be the maximization of the use of available national resources and the progressive local control of the factors that regulate the supply of building materials to the construction industry.

Nature and deficiencies of existing production systems

33. The majority of plants set up in many African countries during the past 25 years to produce some items of essential building materials share some or most of the following characteristics:

(a) application of highly capital intensive (sometimes sophisticated) technologies,

(b) use of a high component of imported raw materials,

(c) concentration in a few locations, specially in the vicinity of capital cities and other large towns,

(d) initially established through turn-key contracts for which technical and management expertise was provided by foreign exprrts during the initial years of operation,

(e) maintenance and repair problems arising from the need to import spare parts for which foreign exchange may be lacking when needed,

(f) low utilization of installed plant capacity due to factors including lack of raw materials, plant repair problems (sometimes inability to replace obsolete machinery and equipment), lack of qualified technical and managerial personnel, unstable demand schedules.

34. Following the introduction of building materials like portland cement for which plants were set up locally or funds were available for their importation, there has been a tendency to neglect artisanal methods of production which had hitherto produced the bulk of materials like burnt bricks and lime used predominantly in the informal building sector in both urban and rural areas. Thus, traditions established over long periods of time have been lost. Artisanal production methods are still practised in some countries, for example in Malawi, Ethiopia, Rwanda, Burundi and Zaire.

35. The deficiencies associated with existing patterns of production have been evident from the persistent shortages and high cost of building materials in several countries. Geographical availability of materials has also been problematic because of constraints associated with moving them from centralized plants to all locations within countries where transport networks are poorly developed. High transport costs lead to a doubling of building materials prices in some localities.

36. It is also evident that investments in production units that have been operating at low capacities, often below the break-even point, have been uneconomic from the view point of utilization of scarce financial resources. Experiences to-date call for a critical review of past strategies and criteria for investments in building materials plants. The new strategies and criteria should aim at contributing to eliminating the deficiencies that characterize existing production systems.

Decentralization as a stimulus for diversification in range of available building materials

37. It has already been observed that a major defect of building materials production systems at the national level in the past has been the concentration of plants in a few locations, sometimes producing only a limited range of materials. While it is

true that this pattern was dictated by optimal locational choices based on availability of raw materials infrastructure and services for production and accessibility to profitable markets, it tended to ignore production possibilities in small localized market zones.

38. Two aspects of decentralization of production deserve mention. Firstly, situations may arise in the production of a specific material where it may be necessary to break up the production process among plants in different locations. For example, in the production of portland cement, economic considerations may require that clinker is produced near the source of raw material, and hauled to clinker grinding centres in different locations, near the major consumption centres.

39. The second aspect of decentralized production concerns the deliberate promotion of production units based on the concept of utilization of available raw material reserves, irrespective of size, through the application of appropriate production technologies, to serve markets which may be of a local, regional or national character. This approach permits a thorough examination of all possibilities for building materials production in the country and offers a practical basis for increasing the supply of materials through an optimum use of local resources. To this end the increased production of materials like lime, lime-pozzolana, burnt bricks, clay roofing tiles, sawn timber, etc. which are easily amenable to the use of medium- and small-scale technologies could be enhanced.

40. This system of production is advantageous because it helps to improve the situation regarding the supply of some building materials in the area of influence of the production units. It also helps to reduce the incidence of long distance haulage of materials which is not only costly, but sometimes is constrained by inadequate transport networks.

Decentralization as a stimulus for the development of local technology, skills and entrepreneurship

41. The concept of decentralization of production is intrinsically linked to the adoption of different levels of technology to suit the conditions in different localities within the country. Thus a technology mix of large- medium- and small-scale technologies would be required depending on the scale of production envisaged.

42. There is currently a gap in production technology in African countries, particularly with regard to those suitable for small-scale enterprises. The viability of decentralized system of production would therefore be contingent upon the development of a bank of appropriate technologies. This development could have favourable consequences for the national economy as a whole as illustrated below.

(a) It should give an impetus to research and development institutions, as well as industrial promotion organizations, to strengthen their activities geared to the development of appropriate production technologies, thereby raising their level of expertise and increasing the technological wealth of the country;

(b) The machines, tools and equipment required for locally developed production technologies or those adapted from foreign technologies, would create a demand that would be conducive to the development or strengthening of indigenous capacities for their fabrication;

(c) Linked to (a) and (b) is the development of skills in the production of items of building materials, as well as in their utilization in construction;

(d) The availability of a technological base that provides a range of options would help in stimulating the interest of entrepreneurs specially in the small-scale sector. The successful integration of such entrepreneurs in the production sector would augur well for the developeent of local entrepreneurship in the building materials sector. The experience gained by entrepreneurs in this sector could easily be applied in other productive sectors of the economy.

43. Decentralization of the productoon of building materials should thus be viewed as an instrument for enhancing the general economic, social and technological development of the country.

The role of small-scale building materials units in decentralized production systems

44. The promotion of small-scale manufacturing industries has assumed increasing importance in recent times as an industrial development strategy, especially in rural areas. Not that these industries did not make any significant contributions to the achievement of national develo,ment objectives in the past. However, in many countries of the third world, small-scale building materials industries and others operated predominantly by the informal sector, had been neglected and thus faced serious problems, including lack of development infrastructure that would afford assistance and facilities with regard to finance, technological innovation, rationalization of production units, technical and managerial training, quality control and standardization. The resulting inefficient operations and poor quality products detracted from the expansion of the role of small-scale units in the production of the materials required by the construction sector, both formal and informal. Unfortunately, most of these problems still prrsist in many African countries.

45. The nature of construction demand and the distribution of natural resources, combined with the inherent advantages of small-scale building materials units create a situation where such units could play a vital role in meeting the demand for building materials. These factors are elaborated briefly below.

(a) The demand for construction is dispersed over the national geographical space;

(b) Climatic factors sometimes favour the use of certain building materials rather than others. For example, burnt-bricks, because of their superior insulating properties are more suitable than concrete blocks for wall construction in hot dry climatic zones;

(c) Small-scale production units are able to utilize dispersed and small raw material deposits to serve local markets; this is specially vital in the context of rural areas where local demands are usually small;

(d) In meeting the local demand for some building materials, small-scale plants help to minimize the impact of the problems of long-distance haulage of building materials on local construction activities;

(e) Flexibility in the scale of production can be achieved in small plants, because of low fixed costs, adjustments in production levels could be made in consonance with demand fluctuations without disastrous consequences on future operations as is the case with large-scale and capital-intensive units;

(d) Because of low capital investments, small-scale plants should normally be easier to finance and are therefore more likely to be in the reach of local entrepreneurs and co-operatives;

(g) Small-scale plants tend to be labour-intensive and therefore offer prospects for high employment generation;

(h) Small-scale plants also generally have low energy requirements, depend little on imported inputs, and thus make fewer demands on scarce foreign exchange.

46. The contribution of small-scale plants to the supply of building materials is not clearly known and therefore not fully appreciated in many African countries because their activities are not usually reflected in the official production statistics. This could have contributed to the low priority for the development of such plants in government industrial promotion programmes in the past, and hence their poor present state. It should be observed however, that some countries have set up industrial development and promotion organizations to cater to the specific needs of small-scale industries. For example, the Kenya Industrial Estates Limited (Kenya) and the small Industries Development Organization (Tanzania) were set up respectively in 1967 and 1973, both with mandates to asist in the establishment and running of small-scale industries in the respective countries.

47. National strategies and programmes for the development of small-scale industries should be formulated and implemented in countries where this has not already been done, so as to exploit the potential contribution of small-scale building materials production units to the minimization of building materials supply problems. The characteristic problems of small-scale manufacturing ventures should be recognized so that adequate remedial measures can be instituted. Some of these measures are discussed further in Chapter V. They include the setting up of industrial development and promotion organizations with emphasis on building materials (and other) industries to provide assistance with respect to the mobilization of financial resources, training for production and managerial skills, planning and rationalization of production units, provision of access to information sources. Standardization and quality control of the products of small production units and the recognition of such products in national building legislations also deserve urgent attention.

CHAPTER III

PROBLEMS OF DECENTRALIZED SYSTEMS OF BUILDING MATERIALS PRODUCTION

48. While decentralized systems of building materials production, properly planned and executed, could make an important contribution towards improving the supply situation of some essential building materials, it has to be recognized that there are factors which could act as severe hindrances to the implementation of such production systems.

49. Some of the problems associated with these factors could be overcome through government policy measures and the introduction of suitable technology options. Others would however require large capital expenditures which would need to be programmed over a long period of time. Financial constraints may limit the ability of governments to intervene in a significant way to facilitate the implementation of production systems based on the concept of decentralization.

50. Some problems and possible approaches to their solution are briefly discussed below.

Absence of basic infrastructure

51. One of the important factors considered in decisions on the location of industrial production plants is the availability of such infrastructural facilities as water, electricity, transport and communications services. They are essential for the production process itself, and also for the marketing of the goods that are produced.

52. In most of the African countries, infrastructural and other services are concentrated in cities and other large urban settlements, which in certain countries are only a few. Large segments of many countries lack such services and therefore fall to attract industries when traditional investment criteria are applied. Besides, accessibility to such areas could be problematic. Small and medium-scale entrepreneurs who are, by and large, averse to risk, also tend to locate in large settlements where they can be sure of getting the basic services necessary for their operations and also good accessibility to markets.

53. There are situations where an investment package for a building materials project (for example, for cement or timber products) would include the provision of the basic services needed at a site away from already developed population centres. This would usually be the case for rather large-scale projects, returns on which are large enough to cover repayment costs of services considering that there may be no other consumers of those services.

54. The problem to be addressed therefore concerns the enhancement of the attractiveness of the greater part of the country as investment centres, even if only for small- or medium-scale plants. While this is a desirable goal the realities of the economic situation in African countries point to difficulties in achieving concrete results in the short-term. However, long-term planning based on a recognition of the importance of the building materials industry in the national economy, and explicit reference to its role and investment requirements in national economic development plans could help to improve the investment climate for building materials projects in

the various regions of the country. Long-term planning for the development of the national road network, electricity and water supply systems should be used as an instrument for creating favourable conditions for the achievement of the targets of the national building materials development plan. Attention should also be given to building materials industries in the planning of integrated rural development projects. The needs of such industries would then be a key factor to consider in the planning of those projects.

55. The foregoing considerations notwithstanding, there are some measures which could be taken, where feasible, to overcome some of the locational disadvantages caused by the absence of basic infrastructural facilities. These include:

(a) The use of diesel generators to provide electric power requirements of the plant. This may necessitate the installation of adequately sized tanks to store diesel oil requirements;

(b) The use of diesel-owned machines in the production process;

(c) The use of labour intensive techniques with minimum requirements of electrical power;

(d) Development of energy plantations based on quick-growing plant species to be used as solid fuel in thermal power stations for generating electrical power.

(e) The choice of sites where water from bore holes or nearby stream or river could be utilized. Sites close to existing settlements could be advantageous in this regard.

Market size

56. The viability of a building materials plant depends on, among other factors, the availability of markets for its products. Location in the vicinity of major consumption centres or in areas with easy access by one or more transport modes to such centres is therefore to be preferred. Siting of plants in localities poorly served by the existing transport network is unattractive.

57. Even when good transport services are available, it has to be recognized that for some items of building materials, with low value/weight ratios, like burnt clay bricks, there are maximum economic distances over which they can be transported. The viability of the project can therefore not be sustained if the major consumption centres are outside the range of this economic distance.

58. Fortunately however, the production of some items of building materials lends itself to the use of different scales of technology with different output legels. This means that for some materials there is a possibility to have plants of different sizes to satisfy different market sizes. Thus in rural and small town locations, certain materials could still be produced to serve limited local demands.

59. In planning for the production of building materials based on the utilization of local raw materials resources therefore, consideration should be given not only to conventional plants tailored to the needs of large market centres, but also to plants that could employ small-scale technologies to serve small markets.

60 . It may also be necessary sometimes for governments to help in creating the initial markets for unpopular building materials whose widespread use could, for example, lead to the substitution of imported alternttives. In such cases governments could institute measures to guarantee markets for the materials through a commitment to use them in government sponsored projects, and in the building programmes of national housing development and construction organizations.

Absence of complementary industries

61. Another advantage of locating industries in cities or large market centres if the availability of a large number of other industries where products may be required as inputs for the new industries. At the same time there is the added advantage of easy assess to spare parts and competent mechanics for the repair of broken-down machinery and vehicles. Industries in other locations would tend to maintain higher inventories of raw materials and finished products because of irregularities in transport and supply networks. While this may be critical for some industries, it does not appear to be so for the whole range of building materials that could be produced within the country. This factor may therefore not be crucial in the siting of some building materials industries in rural and small town locations.

62. The planners of building materials production units in rural locations should however take due account of the issues raised by complementary industries and provide for measures that would help to overcome bottlenecks likely to occur during the operational phase of the projects.

Problems relating to availability of suitable technologies

63. The concept of decentralization of building materials production implies, as already noted, the utilization of a range of technologies to suit conditions in specific locations. Thus the use of small-scale technologies based on labour intensive processes would be appropriate in some situations, while in others, large-scale mechanized methods or medium-scale, semi-mechanized methods will be required.

64. Conventional technologies for the production of some materials like cement, steel and glass tend to be so specialized that technology packages have been provided to date by a small number of firms located mainly in developed countries. The choice of a specific technology is usually dictated by the nature of conception of the project and the major group financing its implementation. The availability of technologies for large-scale and also medium-scale production of variety of building materials does not usually pose serious problems. Problems, however, arise when wrong choices are made. Suitable criteria for the selection of production technology should therefore be formulated and enforced. Appropriate technologies for the small-scale and handicraft production sector however require attention with regard to their development and use in the context of African countries.

65. In a number of African countries there has occurred the phenomenon whereby following the introduction of cement and other modern materials, there has been a gradual disappearance of handicraft units producing materials such as burnt bricks and roofing tiles in rural and peri-urban areas. The basis of traditional small scale technologies, applied mainly in the informal sector, has therefore been eroded in such countries. The impact of this phenomenon seems to have been more marked in the countries where the production methods employed in these units had been introduced particularly by foreign settlers during the colonial era. In the countries where

handicraft production methods are still practised, inefficient production systems and poor quality products hamper the growth of this production sector and limit its potential to contribute significantly for the supply of building materials required, specially by the formal construction sector.

66. The problems of technology availability can be summed up as the need for small-medium-, and large-scale technologies that can be sustained by a country's level of social, economic, technological and manpower development so that their continued application and maintenance can be guaranteed. The following measures are among those that need to be given attention to minimize the problems posed by production technology.

(a) Planners and decision makers should assess the consequences of available technology options considered appropriate and evolve measures to ensure the successful application of the chosen technologies. Such measures might include the strengthening of the training component of specific projects or planning for adequate technical back-up services.

(b) In negotiations on building materials projects for which external financing is sought, a careful examination of the technology component should be undertakin to reduce the risks of failure during the operational phase of the projects. In the countries where the expertise for such evaluation exercises are lacking, local capacities would have to be built up either within the national planning office or in some other local organizations.

(c) Local capacities for technology development and adaptation in the building materials sectors should be built up or strengthened. Emphasis should be on small- and medium-scale technologies with such levels of mechanization as can be sustained without recourse to external expertise for long-term operation and maintenance.

(d) Concerted efforts should be made to reintroduce lost traditions of small scale building materials production in rural and peri-urban areas. The success of such efforts would depend on the participation of the private and informal sector. Governmental support through the introduction of improved production techniques and management practices that will ensure efficient operations and better quality products as well as back-up services involving research and development, pilot and demonstration projects and technical assistance, would also be necessary.

Energy considerations

67. Building materials industries, in general, consume large amounts of energy (fuel and electricity). The traditional sources of energy have however become expensive in recent times and in many African countries energy could be considered as a scarce commodity. In rural areas of forest zones, firewood has traditionally been the major source of fuel, not only for domestic use, but also for handicraft units producing building materials.

68. Energy supply in rural and remote locations is increasingly becoming problematic due to poor accessibility which hinders the supply of oil products (these products have also become expensive as a result of successive price increases on the world market), absence of electrical power generating facilities or connections to the national power grid, and also due to dwindling firewood supply. Building materials plants located in such areas are therefore likely to face severe problems in maintaining sound operation schedules.

69. In the light of the above problems, new approaches to meeting energy needs in rural and remote locations for uses including the requirements of building materials industries have to be examined for possible implementation. In this connexion, the concept of energy plantations based on the systematic planting and raising of some quick-growing plant species deserves critical examination. Such plantations would not only provide solid fuel for use in thermal power stations for electrical power generation, but could also provide fuel for use in building materials plants based on firewood. Besides, timber is a renewable resource.

70. Among the advantages of energy plantations are the following:

(a) They could make a sizeable contribution to the growing energy needs of a nation and to that extent lessen the energy crisis;

(b) Transportation of fuel resources could be reduced to a minimum and power generation could be decentralized which would help to develop the rural economy.

71. Another source of energy that could be developed to meet needs in rural areas is from micro-hydroelectric plants. In areas with suitable rivers and rainfall these plants could offer opportunities for producing power for small industries and domestic use at costs comparably lower than are possible with other alternatives. Governments should initiate studies to assess the opportunities for the construction of micro-hydro power plants, and formulate programmes for further actions where necessary, including the development of pilot schemes.

72. The following measures should also merit careful consideration by government planners, decision-makers, and industrial promotion organizations:

(a) Establishment of quick-growing timber plantations as integral components of building materials production schemes;

(b) Utilization of agricultural residues like rice husk, bagasse, groundnut shells and saw dust as fuel for materials production should be investigated. Use of rice husk for brick burning has been tried in India. Studies on the use of these fuels should be undertaken in the context of the situation in African countries;

(c) Development and introduction of less energy intensive or more energy efficient materials production technologies;

(d) Development and application of techniques for utilizing solar energy in building materials production.